

## Using Active Learning in the Classroom

(Go to the OSET website for links to active-learning resources)

*Learning is not a spectator sport. Students do not learn much just by sitting in class listening to teachers, memorizing prepackaged assignments, and spitting out answers. They must talk about what they are learning, write about it, relate it to past experiences, apply it to their daily lives. They must make what they learn part of themselves.*

Chickering, A & Gamson, Z. F., 1987, Seven principles for good practice. *AAHE Bulletin* 39: 3-7.

### What is Active Learning?

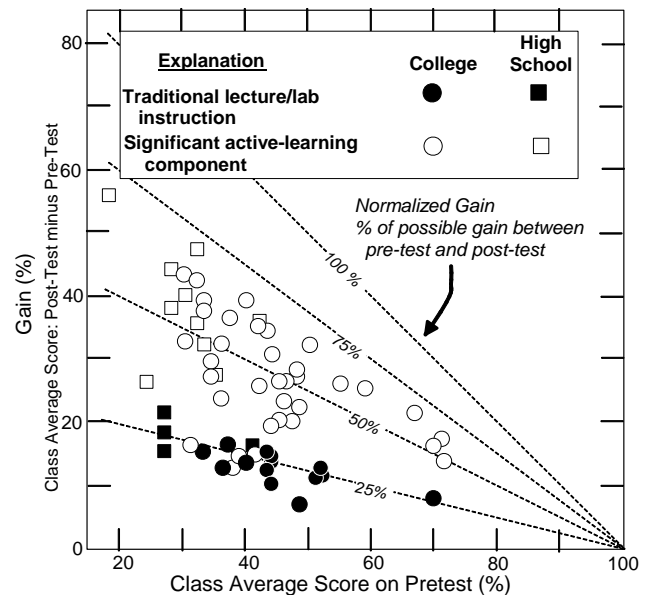
Active learning includes all class activities where students do something and think about what they are doing. When students undertake active learning they are not simply learning subject matter but they apply concepts and explore relationships between concepts, facts, and contrasting points of view. Through these activities, students construct knowledge for themselves, rather than simply receive knowledge from the instructor.

Students can certainly actively engage with course material by writing or studying with classmates outside of class. However, the strength of active learning lies in the fact that it happens during class time. Most, though not all, active learning strategies involve students working with one another to discuss conflicting viewpoints, to clarify each other's points of confusion, or use teamwork to combine expertise to solve problems.

Active learning includes approaches that have received a variety of labels in the pedagogy literature: discussion, cooperative learning, collaborative learning, interactive engagement, team-based learning, peer instruction with clickers, etc. In short, active learning refers to anything that students do in a classroom except passively listening to an instructor's lecture.

### Why Use Active Learning?

Research has shown that, regardless of the subject matter, when active learning is compared to traditional teaching methods (such as lecture), students learn more material, retain the information longer, are more likely to get higher grades, report being more satisfied, and are more likely to persist and graduate. Students are also more likely to report higher levels of participating in other desirable activities, such as challenging academic work, diversity experiences, and contact with faculty.



The impact of active learning on student learning is illustrated in this graph that illustrates class averages on pre- and post-tests of fundamental conceptual knowledge in first-semester introductory physics. Learning gains in active-learning classes are typically two to three time higher in comparison to lecture courses. The data set includes more than 6500 students in 62 classes. (From R. Hake, 1998, *Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses*, *Am. J. Phys.* 66: 64-74)

The scholarship on teaching and learning indicates that the lecture format where faculty do most of the talking and students listen is contrary to almost every principle of an optimal learning environment. In contrast, active learning approaches that involve students working with each other during class features three essential elements for student learning:

- Active learning engages students in their learning
- Active learning increases their time on task to construct knowledge
- Active learning takes advantage of peer influence.

When, as a part of active learning, students write something to turn in, the instructor can use these assignments to assess student learning. These classroom assessments improve student learning and persistence, whether they are graded or simply reviewed for evidence of student learning with general feedback. Classroom assessment through

active learning improves student outcomes because it promotes students' awareness of their own learning and it provides feedback to faculty about what is and not being learned in the classroom.

## **Approaches to Active Learning**

### **Adapting the Lecture Format**

Some active-learning strategies can be employed with only minor modification of a traditional format where the instructor lectures for the entire class period. The key is to break up lecture time with time for students to reflect on what they are learning and/or to discuss new content with classmates. Popular approaches include the "minute paper" where students write a short paragraph that summarizes their understanding of a key concept, or pauses where students compare notes or develop questions about the lecture that are then shared and answered with class discussion. In think-pair-share, a problem or question requiring application or synthesis of lecture concepts is presented; students then discuss solutions or answers in small groups, and lastly, selected groups report-out to the whole class followed by discussion, elaboration, or clarification by the instructor. Peer-instruction is a variant of think-pair-share that is typically employed using classroom response systems (also called "clickers"). See the Teaching with Clickers page on the OSET website for more information about peer instruction and related strategies.

### **Cooperative and Collaborative Learning**

Active learning is most effective when it engages students to work with one another. The terms cooperative and collaborative learning describe these strategies. The terms are synonymous for some educators but take on very different meanings for others. Given the lack of consistent definitions for cooperative and collaborative learning, we will lump them here to mean any form of active learning where students work together in small groups.

A small-group exercise can range considerably in scale and expectations. It can be a highly-structured group project that occupies many weeks of a course, or it can simply be a few tens of minutes spent during class time where students complete a questionnaire or worksheet while benefiting from discussion with peers and the instructor. In some cases the instructor may assign the teams of students who will work together throughout the course, perhaps with assigned duties within the team; in other cases groups may form informally on the occasion of each assignment. The resulting work

may or may not be graded, groups may be formally assigned or self selected, and participants may be assessed as a group or individually. A variety of strategies have been described for cooperative and collaborative learning (e.g., *Collaborative Learning Techniques: A Handbook for College Faculty*, by E. Barkley, K. P. Cross, C. H. Major, 2004, Jossey Bass).

Group work can take place in classes of any size. Even in large lecture halls, students can readily work together in groups of 2 to 6. Worksheets or simple written assignments can replace a lecture or break up a lecture period. In one scenario, a lecture over key concepts can be followed by a group exercise where students apply the concepts or integrate them with previously learned material or a reading assignment.

### **Team-Based Learning**

Team-based learning is a special type of small-group learning that moves out of the lecturing environment and, simultaneously, develops strong teamwork skills among students. In a typical scenario, course content is divided into modular units, each of which occupies two to three weeks of class time. After making first contact with fundamental content by reading, students then launch into successive class periods of content application through work in predetermined small groups. Initial group assignments are typically rather simple and then progressively ramp up to more complex and sophisticated outcomes. Learning is assessed through a culminating group project or exam and then the process starts over with a new module of content. The method is well explained at the University of Oklahoma Team-based Learning Website by Larry Michaelsen, who originated the pedagogical strategy in the 1970s (<http://www.ou.edu/pii/teamlearning/index.htm>).

The website has abundant resources for starting instruction with team-based learning, including video clips.

### **Problem-Based Learning**

Problem-based learning is a form of active learning where students start by facing an authentic problem that needs to be solved and then determine what they need to learn and understand in order to solve the problem. This approach strongly centers on the learner, who must recognize what they need to know, access that information, develop a firm understanding of fact, concepts, and methods, and then apply all of these to solving the problem.

Problem-based learning can be done individually as well as in groups. The approach has seen widest use in the health-care disciplines but is broadly applicable within higher education. A good place to start learning more about this strategy, especially for large classes, is at the PBL Website at McMaster University (<http://chemeng.mcmaster.ca/pbl/pbl.htm>), where the method originated. There are also resources at the UNM School of Medicine Teaching and Education Development website (<http://hsc.unm.edu/som/TED/>).

## **What if Students Resist Active Learning?**

Despite our best intentions, active learning can work poorly in the classroom if students do not understand why they are learning this way. Most of your students may be more accustomed to simply listening to lectures. If students have not previously used active-learning strategies then they may be concerned and frustrated by your progressive teaching approaches. Active learning places an expectation on them to come to class prepared because they need to make first contact with content before coming to class in order to engage in work with their classmates.

It is important that students know why you teach the way that you do. They should know what your goals are for the course and understand how you plan to help them achieve mastery of those goals. Resistance to active learning subsides, or never develops, if students see that in-class activity enhances their learning and is consistent with their learning expectations from the course. The OSET website resource, *How Will My Students Respond to Active Learning?* provides guidance on activities that you can use to engage your students in the value of active learning within the first few days of your course.

## **Additional Resources for Active Learning Strategies to Use in Your Classroom**

Besides the references cited above, the following websites provide invaluable information and ideas to inspire your use of active-learning strategies:

*Professional Development Module on Active Learning*, by Diane Starke, Texas Collaborate for Excellence in Teaching. This website not only contains a resource-rich description of active-learning strategies but also dozens of reference citations about active learning

strategies in specific disciplines.

<http://www.texascollaborative.org/activelearning.htm>

*Active/Collaborative Learning*, Arizona State University. Although the website is subtitled "Best Practices in Engineering Education," the site contains many helpful sections on using active-learning strategies, including testimonials from professors. <http://cite.asu.edu/active/mainre.htm>

Active Learning in Diverse Classrooms. An information-rich web tutorial provided by the *Minnesota State Colleges and Universities Center for Teaching and Learning*.

<http://ctlactivediverse.project.mnscu.edu/>

*Active Learning: Creating Excitement in the Classroom*, by Charles Bonwell and James Eison. The National Teaching & Learning Forum.

<http://www.ntlf.com/html/lib/bib/91-9dig.htm>. A summary essay based on a larger book by the same title that describes active learning, including some strategies.

*Teaching and Learning Methods and Strategies*. University of Arizona

<http://www.u.arizona.edu/ic/edtech/strategy.html>. A website of links to information on a variety of active-learning methods.

*Active Learning Strategies. Summaries of Best Practices in College Teaching*.

<http://www.fctel.uncc.edu/pedagogy/basicscoursedevelop/BestPractices.html>. An essay that describes, in a few words, dozens of active-learning approaches.

*Incorporating Active Learning into Your Lectures* by Colin Baird and Karen Edge, The University of Western Ontario.

[http://www.uwo.ca/tsc/re\\_active\\_learning.html](http://www.uwo.ca/tsc/re_active_learning.html). A short article on easy-to-use strategies for bringing active learning into traditional lecture courses.

*The Web: Design for Active Learning*, a handbook by Katy Campbell at the University of Alberta, illustrates the framework for incorporating active learning into online instruction.

<http://www.atl.ualberta.ca/documents/articles/activeLearning001.htm>

*Strategies to Incorporate Active Learning into Online Teaching*, by Diane Austin and Nadine D. Mescia, University of South Florida, concisely summarizes the use of active learning in online instruction, with many references.

[http://www.ictc.org/T01\\_Library/T01\\_245.pdf](http://www.ictc.org/T01_Library/T01_245.pdf)

*Navigating the Bumpy Road to Student-Centered Instruction*, by R.M. Felder and R. Brent, 1996,

College Teaching, v. 44, #2, p. 43-47.  
<http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/Resist.html>.

A commonly cited frank summary of the difficulties faced by both students and faculty when first encountering learner-centered rather than teacher-centered instruction, and possible remedies.

mechanics test data for introductory physics courses." (1998). *American Journal of Physics*, 66, 64-74.

<http://www.physics.indiana.edu/%7Esdi/ajpv3i.pdf>

Important book references on active learning:

Angleo, T.A. and Cross, K.P. (1993) Classroom assessment techniques (2<sup>nd</sup> ed.): San Francisco, Jossey Bass

Barkley, E.F., Cross, K.P., and Major, C.H. (2005). Collaborative learning techniques. San Francisco, Jossey Bass.

Bean, J.C. (2001). Engaging ideas: The professor's guide to integrating writing, critical thinking, and active learning in the classroom.

Bonwell, C.C., and Eison, J.A. (1991). Active learning: Creating Excitement in the Classroom. Washington, ASHE-ERIC Higher Education Reports, Report 1.

Johnson, D.W., Johnson, R.T., and Smith, K.A. (1991). Cooperative learning: Increasing college faculty instructional productivity. Washington, ASHE-ERIC Higher Education Reports, Report 4.

Mills, B.J., and Cottell, P.G., Jr. (1998). Cooperative learning for higher education faculty. Westport, American Council on Education.

### **References on the learning effectiveness of active learning:**

Springer, L., Stanne, M. E., and Donovan, S. (1998). "Effects of cooperative learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis." (*Research Monograph* No. 11). Madison: University of Wisconsin-Madison, National Institute for Science Education, Review of Educational Research  
<http://www.wcer.wisc.edu/nise/cl1/CL/resource/R2.htm>

Felder, R., Felder, G., and Dietz, E.J. (1998). "A longitudinal study of engineering student performance and retention vs. comparisons with traditionally-taught students." *Journal of Engineering Education*, 87(4), 469-480.  
<http://www.ncsu.edu/felder-public/Papers/long5.html>

Hake, Richard R., "Interactive-engagement vs. traditional methods: A six thousand-student survey of